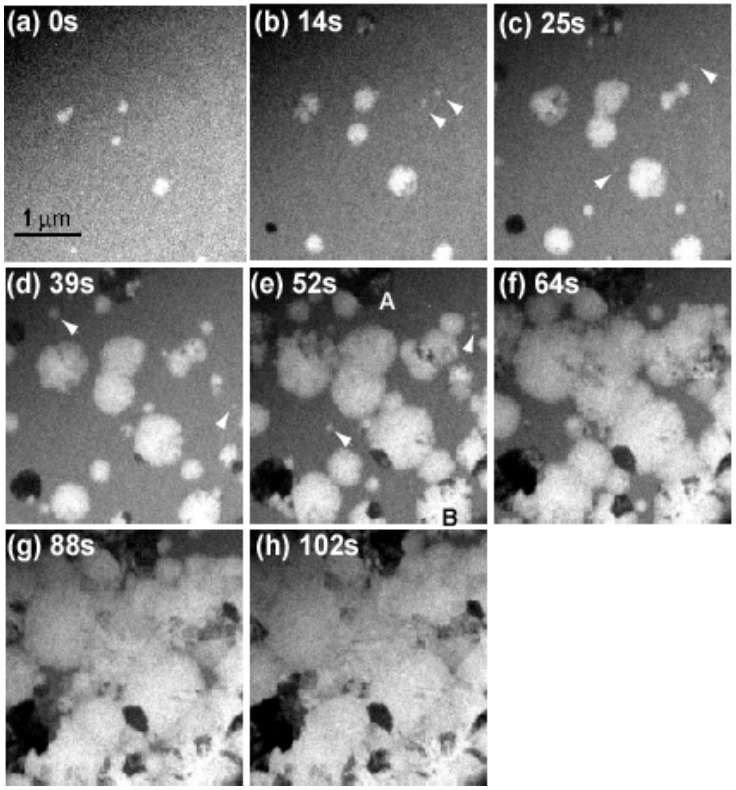
CAREER: Robust Thin Film Shape Memory Alloys for MEMS

A. G. Ramirez, Yale University, DMR-0347095

Shape memory alloys exhibit the captivating property of "remembering" their original shape and returning to it when heated. They have numerous uses in their bulk form as fasteners, auto-shut off valves, and medical stents. What is new, however, is the understand-ing of their thin film behavior and their full integration as actuation materials in micromachines or microelectromechanical systems (MEMS). As such, the aims of this research is to explore the behavior of thin film NiTi shape memory materials; improve their integration into the MEMS process; and broaden the understanding of thin film me-chanical properties, by examining materials that exhibit elastic non-linearities.

H. -J. Lee and A. G. Ramirez Appl. Phys. Lett. **85**(7) 1146 (2004)



Transmission electron microscope (TEM) images showing the crystallization of 0.2 μm thick amorphous nickel-titanium films annealed at 470°C for 5 minutes at (a) time of onset (5 min) to (h) full crystallization 102 seconds later.

LUX ET VERITAS

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Education:

•Created a new introductory MEMS class for undergraduates called the "Materials Science of MEMS" (ME 385)

•Advised undergraduates Jonathan Kerner (04) (senior project-Mechanical properties of NiTi films), Yusef Ali (05) (summer project-Thin Film mechanical testing), and Noah Kalman (06) (project-Thin Film mechanical testing)

•Revamped the introduction to materials science class by incorporating demonstrations and in class group projects. Compiling a database of materials science demonstrations with the Materials Research Society (MRS).

•***Training***: Dr. Hai Ni (post-doc) and Dr. Hoo-Jeong Lee (research scientist) contribute largely to these research efforts.

Outreach:

•Gave a speech about science to 300 high-school girls at Princeton Plasma Physics Laboratory.

•Advisor to Yale Scientific Magazine

•Participated in the Women Leadership Panel for high school girls (at Brown University)

Award/Honors

•Selected to participate in the National Academy of Engineering's Frontiers of Engineering program.